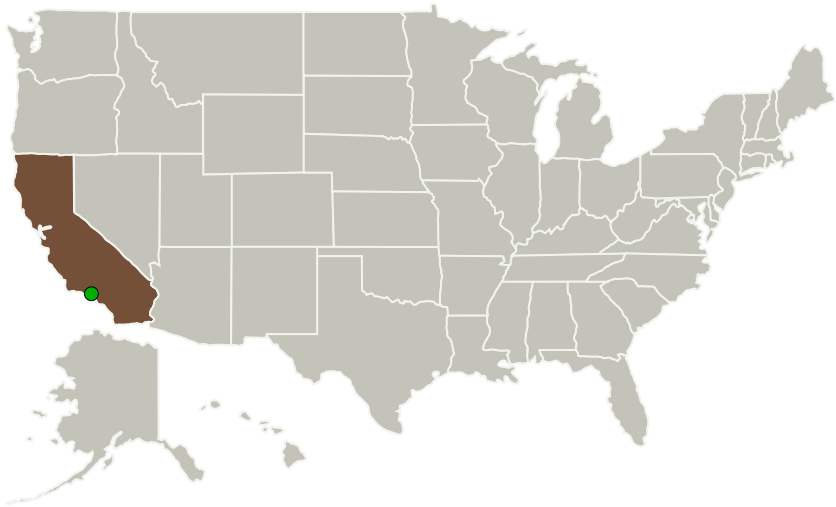
Deep Space Cryocooler System (DSCS), Phase II

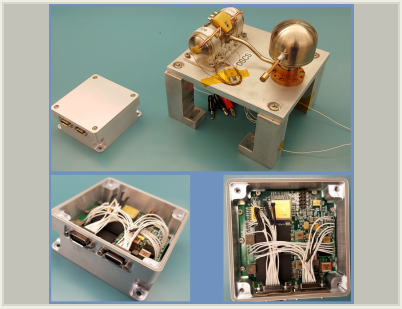
Completed Technology Project (2017 - 2019)

Project Introduction

The Iris Technology and Lockheed Martin team has developed a cryocooler system design which meets the S1.09 SBIR topic goals at twice the desired cooling capacity (0.4W at 35K) delivering Engineering Model hardware under DSCS Phase II for both the cryocooler and its optimized control electronics. The DSCS Program builds off the previous successes of the USAF "MicroSat Cryocooler System (MCS)" Program (FA9453-14-C-0294). The DSCS extends the Miniature Low Cost Cryocooler Electronics (mLCCE) performance reducing size, weight and power of the deep-space rad-hard integrated circuits. The DSCS enhances the thermo-mechanical unit with a new inertance tube and regenerator packing to optimize the cryocooler design for 35K cold-tip and 150K heat rejection temperatures. To achieve this higher performance, the DSCS cryocooler is based on the Lockheed Martin Space Systems Company (LMSSC) TRL-6 High Power Microcryocooler. LMSSC's initial trade study shows the predicted performance of the High Power coldhead is significantly better than the standard coldhead. This is largely due to a greater regenerator volume, and thus greater regenerator heat capacity. The High Power coldhead heat exchangers are slightly larger, increasing their effectiveness and improving performance. In addition, Iris proposes the Phase I electronics design will be reviewed against sample planetary mission parts lists in Phase II. The uLCCE provides a mission-critical, radiation tolerant system solution, easily extendible to a radiation hardened flight platform.

Primary U.S. Work Locations and Key Partners





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Organizations Performing Work	Role	Type	Location
Iris Technology Corporation	Lead Organization	Industry	Irvine, California
Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations
California

Project Transitions

April 2017: Project Start

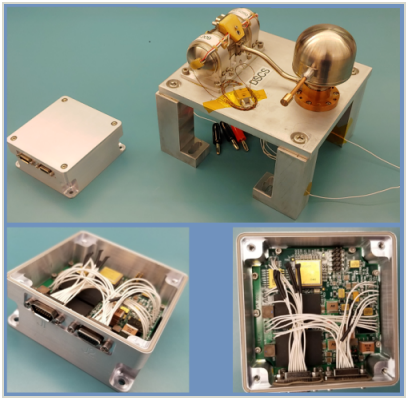
April 2019: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/141056)*

Images

Briefing Chart Image
Deep Space Cryocooler System (DSCS), Phase II Briefing Chart Image
(https://techport.nasa.gov/image/127309)



Final Summary Chart Image
Deep Space Cryocooler System (DSCS), Phase II
(https://techport.nasa.gov/image/133855)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Iris Technology Corporation

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

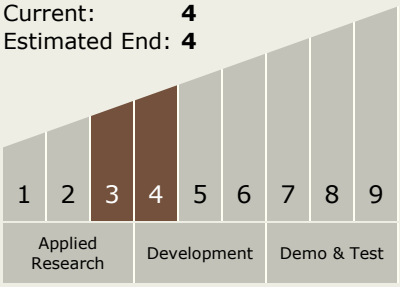
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Marguerite Slater

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



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Technology Areas

Primary:

- TX14 Thermal Management Systems
  - TX14.1 Cryogenic Systems
    - TX14.1.3 Thermal Conditioning for Sensors, Instruments, and High Efficiency Electric Motors

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System